BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1

Title: BOOSTER AGS MODIFICATION

Preparer/Manager: Kevin Brown

Current Cost Est.(FY05 $M) $20.5

Assigned Contingency % 15%

Cost Elements (FY05 $M)

Matls	$7.4
Effort	$6.7
Ohd	$3.3
Conting	$3.1
Total	$20.5

WBS Dictionary Definition: This WBS consists of modifications to the Booster and AGS to prevent RSVP from having an impact on RHIC operations, to allow the Booster and AGS to operate to meet RSVP intensity goals, and modifications that will allow the Booster and AGS to create the beam conditions (bunch structure, frequency, and extinction) as required by RSVP experiments.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	18.8%	Engineered Design	12.0%
Engineered Conceptual	43.3%	Scientist Conceptual	25.9%
Guess	0.0%	Other (specify)	0.0%
		Total	100%

Status of Hardware/Software Development: All Booster and AGS systems have been evaluated based on the impact of high intensity operations on RHIC operations, maintainability of the Booster and AGS for RSVP, and on the basis of achieving the intensity and throughput goals of RSVP. This WBS represents the result of that evaluation as well as those things specified by RSVP in order to perform the experiments.

Issues (funding, collaborator shortage, engineering help, etc.): The only systems which are defined in the WBS but not costed are the Booster and AGS collimators. This is an issue still being discussed within the C-AD AP group and has not developed far enough to allow an engineer to cost out a system.

BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1.1

Title: Project Support

Preparer/Manager: Kevin Brown

Current Cost Est.(FY05 $M) $0.3

Assigned Contingency % 16%

Cost Elements (FY05 $M)

Matls	$0.0
Effort	$0.2
Ohd	$0.1
Conting	$0.0
Total	$0.3

WBS Dictionary Definition: This WBS covers the project management of the Booster and AGS modifications. It includes one FTE Liaison engineer management (PE) and 1/2 FTE physicist project management (PPM).

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists		Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)	Project Management		

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	0%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	100%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: This is the costs just for the management. Both the LE and the PPM are also doing engineering and physics under various subsections of the WBS.

Issues (funding, collaborator shortage, engineering help, etc.): This is the projected costs for managing the Booster/ /AGS WBS for the AGS RSVP Project office. These costs are based purely on previous experience and may not properly reflect the demands of the RSVP project. Upper management advice would be useful, given the management complexities of RSVP.

BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1.2

Title: Booster

Preparer/Manager: Kevin Brown

Current Cost Est.(FY05 $M) $4.9

Assigned Contingency % 19%

Cost Elements (FY05 $M)

Matls	$1.6
Effort	$1.8
Ohd	$0.8
Conting	$0.7
Total	$4.9

WBS Dictionary Definition: Booster Modifications for RSVP: modifications to prevent RSVP from having an impact on RHIC operations, modifications to allow Booster to meet RSVP intensity and beam throughput requirements, and modifications to allow the Booster to remain maintainable throughout RSVP operations.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	20%	Engineered Design	19%
Engineered Conceptual	46%	Scientist Conceptual	15%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: This is mostly repairs and improvements to existing designs. Some new designs are involved, such as LINAC to Booster (LTB) transfer line collimators. It includes C3 inflector projection from high intensity protons, collimation in the LTB transfer line, to protect the Booster C5 and C7 main dipole magnets, RF feedback system for the Booster RF to improve beam capture, improvments to instrumentation, other infrastructure improvements to improve maintainability, and shield caps to prevent activated soil from contaminating ground water.

Issues (funding, collaborator shortage, engineering help, etc.): Does not include collimators for the Booster, an issue still being investigated. Also Shield caps are included entirely as a materials cost, since this work is mostly outside contracted.

BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1.3 **Title:** AGS

Preparer/Manager: Kevin Brown **Current Cost Est.(FY05 $M)** $8.7

Assigned Contingency % 19%

Cost Elements (FY05 $M)

Matls	$3.9
Effort	$2.3
Ohd	$1.1
Conting	$1.4
Total	$8.7

WBS Dictionary Definition: AGS Modifications for RSVP: modifications to prevent RSVP from having an impact on RHIC operations, modifications to allow AGS to meet RSVP intensity and beam throughput requirements, and modifications to allow the AGS to remain maintainable throughout RSVP operations.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	20%	Engineered Design	14%
Engineered Conceptual	56%	Scientist Conceptual	10%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: This is mostly repairs and improvements to existing designs. Some new designs are involved, such as a new Electrostatic septum for extraction. It includes new septa magnets for slow extraction, new power supplies for the new magnets, improvments to instrumentation, other infrastructure improvements to improve maintainability, and shield caps to prevent activated soil from contaminating ground water.

Issues (funding, collaborator shortage, engineering help, etc.): Does not include collimators for the AGS, an issue still being investigated. Also Shield caps are included entirely as a materials cost, since this work is mostly oustside contracted.

BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1.4

Title: MECO AGS Mods

Preparer/Manager: Kevin Brown

Current Cost Est.(FY05 $M) $1.4

Assigned Contingency % 22%

Cost Elements (FY05 $M)

Matls	$0.500
Effort	$0.443
Ohd	$0.244
Conting	$0.209
Total	$1.4

WBS Dictionary Definition: AGS Modifications for MECO gap cleaning during bunched beam slow extraction. This includes a new AC dipole system and stripline kickers, which working together clean the gap between the main beam bunches in the AGS. Also included is simulations for MECO extraction.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	15%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	85%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: Conceptual Design Only. Some aspects of system tested in accelerator studies.

Issues (funding, collaborator shortage, engineering help, etc.): Cost estimate calls for a new AC dipole magnet. Current thinking is a new magnet is not necessary. Cost estimate also assumes power amplifier for strip-line kickers is designed and built in house. Current thinking is this can be contracted outside.

BOOSTER AGS MODIFICATIONS
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.1.5

Title: KOPIO AGS Mods

Preparer/Manager: Kevin Brown

Current Cost Est.(FY05 $M) $5.2

Assigned Contingency % 21%

Cost Elements (FY05 $M)

Matls	$1.4
Effort	$2.1
Ohd	$1.0
Conting	$0.7
Total	$5.2

WBS Dictionary Definition: AGS Modifications for KOPIO. Includes AGS Injection kicker modifications to achieve higher intensity and two new AGS RF cavities that will be used to create the 200 psec micro-bunches for KOPIO.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	18%	Engineered Design	6%
Engineered Conceptual	34%	Scientist Conceptual	42%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: Conceptual Design Only. Some aspects of system tested in accelerator studies. RHIC 28 MHz RF cavities considered as prototype for 25 MHz RF cavity.

Issues (funding, collaborator shortage, engineering help, etc.): Cost estimate calls for a 100 MHz RF Cavity. Whether or not this is needed will not be known until the 25 MHz RF cavity is built and tested with beam. Cost estimates assume majority of Kicker and 25 MHz cavity costs are covered by the Canadian Foundation for Innovation and managed by TRIUMF.

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.1

Title: Project Support

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.3

Assigned Contingency % 16%

Cost Elements (FY05 $M)

Matls	$0.0
Effort	$0.2
Ohd	$0.1
Conting	$0.0
Total	$0.3

WBS Dictionary Definition:

Provides for overall Project support, co-ordination between technical groups, documentation, and installation supervision for modifications to the switchyard

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	0%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	0%
Guess	0%	Previous Proj.Support efforts	100%
		Total	100%

Status of Hardware/Software Development: NA

Issues (funding, collaborator shortage, engineering help, etc.): None

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04

WBS No. 1.4.2.2

Title: Shielding Modifications

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.1

Assigned Contingency % 2200%

Cost Elements (FY05 $M)

Matls	$0.0
Effort	$0.0
Ohd	$0.0
Conting	$0.0
Total	$0.1

WBS Dictionary Definition: Provides for the modification of existing shielding in the switchyard in two areas: Steel shielding will be installed between the AGS ring & the switchyard,allowing access to the switchyard while ions are circulating in the AGS ring. The downstream switchyard labyrinth will be modified to allow easy access to the switchyard

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	10%	Engineered Design	0%
Engineered Conceptual	85%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: N/A

Issues (funding, collaborator shortage, engineering help, etc.): None

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.3

Title: Electrical Modifications

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.7

Assigned Contingency % 24%

Cost Elements (FY05 $M)

Matls	$0.2
Effort	$0.3
Ohd	$0.2
Conting	$0.1
Total	$0.7

WBS Dictionary Definition:

Provides for modifications to the existing 480V power distribution for power supplies to meet NEC code and redistributes power in the switchyard for new equipment. Modifies existing power supplies for a new control system and refurbishs them as needed.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	37%	Engineered Design	45%
Engineered Conceptual	13%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: The power modification uses standard commercial AC breakers installed in our existing distribution panels. The power supply modification uses commercial controllers interfaced with with existing AGS power supplies. This modification has been successfully completed for our most common power supply.

Issues (funding, collaborator shortage, engineering help, etc.): none

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.4 **Title:** Mechanical Modifications

Preparer/Manager: Al Pendzick **Current Cost Est.(FY05 $M)** $0.3

Assigned Contingency % 17%

Cost Elements (FY05 $M)

Matls	$0.1
Effort	$0.1
Ohd	$0.0
Conting	$0.0
Total	$0.3

WBS Dictionary Definition: Provides for two beam plugs & modifies 4 existing magnets for the new beam line. The beam plugs, together with WBS 1.4.2.2 will allow access to downstream radiation areas under certain machine cine operating conditions.Also provides for non-radioactive cooling water supply to water cooled power supplies.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	20%	Engineered Design	65%
Engineered Conceptual	12%	Scientist Conceptual	0%
Guess	3%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: Beam plug design is a copy of the NSRL beam plug. All the magnets are in excellent condition.

Issues (funding, collaborator shortage, engineering help, etc.): none

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.5

Title: Installation

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.9

Assigned Contingency % 1940%

Cost Elements (FY05 $M)

Matls	$0.1
Effort	$0.5
Ohd	$0.2
Conting	$0.1
Total	$0.9

WBS Dictionary Definition: Provides for the removal of 22 magnets and the installation of 10 magnets and 2 beam plugs in the switchyard

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	5%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	0%
Guess	5%	Past Experience	90%
		Total	100%

Status of Hardware/Software Development: NA

Issues (funding, collaborator shortage, engineering help, etc.): none

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.6

Title: Vacuum

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.5

Assigned Contingency % 24%

Cost Elements (FY05 $M)

Matls	$0.2
Effort	$0.2
Ohd	$0.1
Conting	$0.1
Total	$0.5

WBS Dictionary Definition: Provides for the design, fabrication and installation of a vacuum system in th the AGS ring, "A" line & "B" line and modifies the existing controls for these areas.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	20%	Engineered Design	0%
Engineered Conceptual	75%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: The vacuum pumps and hardware are commercially available. The control system needs only minor modifications

Issues (funding, collaborator shortage, engineering help, etc.): Not scrubbed

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.7

Title: Conventional Modifications

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $0.1

Assigned Contingency % 17%

Cost Elements (FY05 $M)

Matls	$0.0
Effort	$0.0
Ohd	$0.0
Conting	$0.0
Total	$0.1

WBS Dictionary Definition: Provides a new enclosure for instrumentation and controls, fire detection, protection, and dehumidification of the Switchyard cave.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	35%	Engineered Design	0%
Engineered Conceptual	60%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: All of the hardware is commercially available

Issues (funding, collaborator shortage, engineering help, etc.): None

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.8

Title: Instrumentation

Preparer/Manager: Al Pendzick

Current Cost Est.(FY05 $M) $1.2

Assigned Contingency % 20%

Cost Elements (FY05 $M)

Matls	$0.4
Effort	$0.4
Ohd	$0.3
Conting	$0.2
Total	$1.2

WBS Dictionary Definition: Provides for the relocation & upgrade of the existing switchyard instrumentation for the new RSVP beam transport. This includes an upgrade of the loss monitor system, EPM's, scanning target, C11 plunging SWIC, C10 SEM, and motion controls. A new current transformer will be installed at C36.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	50%	Engineered Design	20%
Engineered Conceptual	25%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: This is a straight-forward upgrade of existing technology except for the EPM's where some R&D is needed.

Issues (funding, collaborator shortage, engineering help, etc.): not scrubbed

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.9 **Title:** Security Modifications

Preparer/Manager: Al Pendzick **Current Cost Est.(FY05 $M)** $0.4

Assigned Contingency % 20%

Cost Elements (FY05 $M)

Matls	$0.1
Effort	$0.2
Ohd	$0.1
Conting	$0.0
Total	$0.4

WBS Dictionary Definition: Provides for a PLC based access control system for the 3 gates in the switchyard, similar to the NSRL system. This includes gates, key trees and iris scanner, CATV, chipmonks, crash and sweep stations.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	30%	Engineered Design	30%
Engineered Conceptual	35%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: Most of the hardware is commercially available. The software has not been developed but will be similar to the NSRL beam line software.

Issues (funding, collaborator shortage, engineering help, etc.): None

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.10 **Title:** Computer Controls

Preparer/Manager: Al Pendzick **Current Cost Est.(FY05 $M)** $0.3

Assigned Contingency % 23%

Cost Elements (FY05 $M)

Matls	$0.1
Effort	$0.1
Ohd	$0.0
Conting	$0.1
Total	$0.3

WBS Dictionary Definition:

All controls interface hardware fc or the switchyard magnet power supplies and t instrumentation will be procured, assembled, installed and tested. Standard software tools and database are configured, installed and tested.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	36%	Engineered Design	32%
Engineered Conceptual	30%	Scientist Conceptual	0%
Guess	2%	Other (specify)	
		Total	100%

Status of Hardware/Software Development:

No hardware development required. Use of standard RHIC controls elements. Software development is limited to configuring and installing standard components and creating database elements for new modules.

Issues (funding, collaborator shortage, engineering help, etc.):

This WBS has not been scrubbed.

SWITCHYARD
RSVP Review Status Sheet

Date: 12/29/04 12:00 AM

WBS No. 1.4.2.11 **Title:** NASA Relocation

Preparer/Manager: Al Pendzick **Current Cost Est.(FY05 $M)** $0.1

Assigned Contingency % 22%

Cost Elements (FY05 $M)

Matls	$0.0
Effort	$0.1
Ohd	$0.0
Conting	$0.0
Total	$0.1

WBS Dictionary Definition: Provides for the relocation of the NASA experimental area, instrumentation and control trailer from the A-3 line to the switchyard

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	10%	Engineered Design	65%
Engineered Conceptual	20%	Scientist Conceptual	0%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development: Most of the existing hardware will be relocated, the remaining equipment is commercially available.

Issues (funding, collaborator shortage, engineering help, etc.): The proposed position in the switchyard requires installation/removal of the "B" line vacuum. This will add an additional radiation burden for operations and experimental personnel.

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No.	1.4.3	**Title: KOPIO**	
Preparer/Manager:	C Pearson	**Current Cost Estimate (FY05 $M)**	$11.63
		Assigned Contingency	27%

Cost Elements (FY05 $M)

Materials	$ 3.77
Effort	$ 3.62
Overhead	$ 1.98
Contingency	$ 2.26
Total	**$ 11.63**

WBS Dictionary Definition:

Provides the 'B'-line beam transport from the AGS Switchyard to the KOPIO proton target, the KOPIO neutral beam, and the general infrastructure needs for the KOPIO experimental area.

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No.	1.4.3.1	**Title: Project Support and Integration**	
Preparer/Manager:	C Pearson	**Current Cost Estimate (FY05 $M)**	$1.99
		Assigned Contingency	16.4 %

Cost Elements (FY05 $M)

Materials	-
Effort	$ 1.22
Overhead	$ 0.57
Contingency	$ 0.2
Total	**$ 1.99**

WBS Dictionary Definition:
Provides for overall project support by a liaison engineer and liaison physicist.
Provides general engineering and technical supervision support for instrumentation, controls, and security systems
Provides general design and documentation support.
Provides C-AD construction supervision.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists	X	Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)			

Comment(s):

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product		Engineered design	
Engineered conceptual		Scientist conceptual	
Guess		Other (see comments)	100%
		Total	100%

Comment(s): Previous project support experience

Status of Hardware/Software Development: Not applicable

Issues (funding, collaborator shortage, engineering help, etc.): None

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No.	1.4.3.2	**Title: Primary Beam**	
Preparer/Manager:	C Pearson	**Current Cost Estimate (FY05 $M)**	$2.78
		Assigned Contingency	18.5%

Cost Elements (FY05 $M)

Materials	$ 0.66
Effort	$ 1.2
Overhead	$ 0.57
Contingency	$ 0.35

Total	**$ 2.78**

WBS Dictionary Definition:
Provides for labor and materials required to construct the proton transport beam for the KOPIO experiment. This effort starts at the exit of the AGS switchyard and ends at the KOPIO proton target.
The existing equipment in the 'B' lines and 'C' lines will be removed and shielding reconfigured. Nine existing magnets and power supplies will be prepared and installed. New beam instrumentation and a new vacuum system will be fabricated and installed.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists	X	Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)			

Comment(s):

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product	20%	Engineered design	35%
Engineered conceptual	20%	Scientist conceptual	15%
Guess	10%	Other (see comments)	
		Total	100%

Comment(s):

Status of Hardware/Software Development:
Magnets and power supplies are available from C-A inventory
Most radiation shielding is available from C-A inventory

Issues (funding, collaborator shortage, engineering help, etc.):

- Beam transport design is preliminary. Actual design may require additional beam elements
- Beam instrumentation requirements need scrubbing
- Proton target position is influenced by experimental requirements such as production angle, neutral beam size, experimental area size, and experimental shielding requirements.
- Proton beam dump position and design needs further study to minimize experimental background

.

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No.	1.4.3.3	**Title: Common Equipment/Facilities**	
Preparer/Manager:	C Pearson	**Current Cost Estimate (FY05 $M)**	$0.671
		Assigned Contingency	22%

Cost Elements (FY05 $M)

Materials	$ 0.273
Effort	$ 0.169
Overhead	$ 0.132
Contingency	$ 0.097
Total	**$ 0.671**

WBS Dictionary Definition:

Provides labor and materials required to provide equipment common to more than one WBS area and general facilities related upgrades.
The existing Cooling Tower #2 system will be upgraded to provide cooling water for the Neutral beam and experimental area pump skids.
A PLC- based magnet interlock system will be fabricated for the primary beam, neutral beam, and experimental sweeper.
Bldg 912 roof vents will be replaced and sealed.
The EEBA crane will be modified for operation with a radio control system.
All controls interface hardware for the KOPIO beamline magnet power supplies and beam instrumentation will be provided.
An enclosure will be constructed to provide protection/climate control for the controls and instrumentation electronics.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists	X	Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)			

Comment(s):

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product	50%	Engineered design	30%
Engineered conceptual	10%	Scientist conceptual	
Guess	10%	Other (see comments)	
		Total	100%

Comment(s):

Status of Hardware/Software Development:

Cooling Tower #2 systems and distribution piping exists.
Many PLC-based magnet interlock system are utilized by C-A.

Issues (funding, collaborator shortage, engineering help, etc.):

None

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No.	1.4.3.4	**Title: B-Line Security System Mods.**	
Preparer/Manager:	C Pearson	**Current Cost Estimate (FY05 $M)**	$0.486
		Assigned Contingency	19.8%

Cost Elements (FY05 $M)

Materials	$ 0.092
Effort	$ 0.221
Overhead	$ 0.111
Contingency	$ .062
Total	**$ 0.486**

WBS Dictionary Definition:
Personnel access system for the beam cave and experimental area. The system is PLC-based and modeled after the existing NSRL system.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists	X	Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)			

Comment(s):

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product	30%	Engineered design	30%
Engineered conceptual	40%	Scientist conceptual	
Guess	5%	Other (see comments)	
		Total	100%

Comment(s):

Status of Hardware/Software Development:
Most of the hardware is commercially available. The software has not been developed but will be similar to the NSRL beam line software.

Issues (funding, collaborator shortage, engineering help, etc.):
None

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No. 1.4.3.5 **Title: Neutral Beam**
Preparer/Manager: C Pearson **Current Cost Estimate (FY05 $M)** $3.82
Assigned Contingency 37%

Cost Elements (FY05 $M)

Materials	$ 1.78
Effort	$ 0.58
Overhead	$ 0.59
Contingency	$ 0.87
Total	**$ 3.82**

WBS Dictionary Definition:
Provides the labor and materials required to fabricate and install the KOPIO neutral beam.
The neutral beam includes the proton beam target, 3 sweeping magnets, a collimator system, vacuum chamber, and shielding.
Two pump skids will be fabricated to provide closed loop cooling water to the proton target, sweeping magnets, and experimental equipment.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists		Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)	X		

Comment(s): By component parts similar systems exists. Integrated design is Conceptual and challenging

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product		Engineered design	
Engineered conceptual	25%	Scientist conceptual	50%
Guess	25%	Other (see comments)	
		Total	100%

Comment(s):

Status of Hardware/Software Development:
The proposed proton target is based on a Triumph design. Preliminary thermal calculations have been completed.
Preliminary engineering designs have been completed for the 3 sweeping magnets.
D1 magnet is a radiation-hard design developed at C-A for the SNS Project.

Issues (funding, collaborator shortage, engineering help, etc.):

- Baselining the parameters for the proton beam and neutral beam requirements is required to proceed to a final design effort
- Shielding requirements need further study
- Collimator geometry and alignment tolerances need further study
- Sweeping magnet designs need to be optimized for cost and compatibility with existing C-A power supplies
- After KOPIO baselining, a six month preliminary design effort by C-A is required. This effort will integrate the technical design issues for the production target, neutral beam, and experimental area. The design effort will provide the basis for detailed engineering and design.

KOPIO
RSVP Review Status Sheet

Date: January 13, 2005

WBS No. 1.4.3.5 **Title: Neutral Beam**
Preparer/Manager: C Pearson **Current Cost Estimate (FY05 $M)** $3.82
Assigned Contingency 37%

Cost Elements (FY05 $M)

Materials	$ 1.78
Effort	$ 0.58
Overhead	$ 0.59
Contingency	$ 0.87
Total	**$ 3.82**

WBS Dictionary Definition:
Provides the labor and materials required to fabricate and install the KOPIO neutral beam.
The neutral beam includes the proton beam target, 3 sweeping magnets, a collimator system, vacuum chamber, and shielding.
Two pump skids will be fabricated to provide closed loop cooling water to the proton target, sweeping magnets, and experimental equipment.

Technical Level of Confidence:

Prototype Demonstrated		Elements built & tested	
Similar system exists		Similar Technology works	
Novel system concept		No candidate concept yet	
Other (see comments)	X		

Comment(s): By component parts similar systems exists. Integrated design is Conceptual and challenging

Basis of the Cost Estimate: (by percentage of total cost)

Commercial product		Engineered design	
Engineered conceptual	25%	Scientist conceptual	50%
Guess	25%	Other (see comments)	
		Total	100%

Comment(s):

Status of Hardware/Software Development:
The proposed proton target is based on a Triumph design. Preliminary thermal calculations have been completed.
Preliminary engineering designs have been completed for the 3 sweeping magnets.
D1 magnet is a radiation-hard design developed at C-A for the SNS Project.

Issues (funding, collaborator shortage, engineering help, etc.):

- Baselining the parameters for the proton beam and neutral beam requirements is required to proceed to a final design effort
- Shielding requirements need further study
- Collimator geometry and alignment tolerances need further study
- Sweeping magnet designs need to be optimized for cost and compatibility with existing C-A power supplies
- After KOPIO baselining, a six month preliminary design effort by C-A is required. This effort will integrate the technical design issues for the production target, neutral beam, and experimental area. The design effort will provide the basis for detailed engineering and design.

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4

Title: MECO

Preparer/Manager: Dave Phillips

Current Cost Est.(FY05 $M) $12.0

Assigned Contingency % 23.4%

Cost Elements (FY05 $M)

Matls	$2.8
Effort	$4.8
Ohd	$2.5
Conting	$1.8
Total	$12.0

WBS Dictionary Definition:

Beamline transport from the Switchyard to MECO and the experimental requirements for MECO which are C-AD responsibility. This includes project support, the proton beamline, instrumentation, security, controls and experimental requirements.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	16%	Engineered Design	18%
Engineered Conceptual	31%	Scientist Conceptual	10%
Guess	5%	Other (specify)	20%
		Total	100%

Status of Hardware/Software Development:

Issues (funding, collaborator shortage, engineering help, etc.):

Scope of C-AD Solenoid & Cryo Support may change due to recommendations of the Magnet Oversight Group

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.1

Title: Project Support & Integration

Preparer/Manager: Dave Phillips

Current Cost Est.(FY05 $M) $2.21

Assigned Contingency % 16.0%

Cost Elements (FY05 $M)

Matls	$0.00
Effort	$1.36
Ohd	$0.63
Conting	$0.22
Total	$2.21

WBS Dictionary Definition:

Provides for overall project support for the design, fabrication and installation of the C-AD portion of MECO. Coordination is provided between the MECO experiment, technical, administrative & safety groups at C-AD, Safety Committees at C-AD, BNL Central Shops & Plant Engineering and outside vendors & contractors. Technical supervision for C-AD employees. Documentation of the overall layout of the A-Line and MECO Experiment in Building 912. Project support includes the Liaison Engineer & Liaison Physicist for the overall project as well as project support for Beamline Design, Instrumentation, Security and Controls.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	0%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	0%
Guess	0%	Previous Proj.Support efforts	100%
		Total	100%

Status of Hardware/Software Development:

Issues (funding, collaborator shortage, engineering help, etc.):

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.2

Title: MECO Proton Beamline

Preparer/Manager: Dave Phillips

Current Cost Est.(FY05 $M) $5.60

Assigned Contingency % 24.4%

Cost Elements (FY05 $M)

Matls	$1.44
Effort	$2.25
Ohd	$1.01
Conting	$0.90
Total	$5.60

WBS Dictionary Definition:

Design, fabrication and installation of the A-Line transport system for the delivery of the primary beam from the Switchyard to MECO. The existing A-Line and the part of the D-Line will be cleared of existing equipment. New shielding for the Transport Solenoid and Cosmic Ray Shield will be purchased. The 480V power distribution system and controls for magnet power supplies will be updated. The primary transport will have 16 refurbished magnets from existing inventory and 2 new magnets will be designed and built. The vacuum system includes costs for a section of high vacuum for the RFMM, the downstream vacuum closure for the Production Solenoid (PS) and a Helium box between the PS and the beam dump. ODH and fire detection systems will be installed. Facility improvements include Bldg 912 roof repairs (vent fans not covered by preventive plant project maintenance by BNL) and enclosures for instrumentation, controls and RFMM.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	20%	Engineered Design	20%
Engineered Conceptual	40%	Scientist Conceptual	15%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development:

Most equipment for MECO Proton Beamline either exists or is similar to an existing design. Relatively minor exceptions are the Production Solenoid vacuum end cap and the use of bulk zinc shielding as a cost effective non-magnetic radiation shielding for the Transport Solenoid and the Cosmic Ray Shield.

Issues (funding, collaborator shortage, engineering help, etc.):

1) Using shielding from inventory for the Cosmic Ray Shield is a potential cost savings which requires rigging to locate shield blocks with "low" activation levels.
2) The design of beam pitching onto the target needs to be completed, this could increase costs if collimation & shielding are more involved than assumed and it can decrease costs if the new pitching magnets can be replaced with magnets from inventory.
3) The need for ODH detection in the beam cave may be eliminated if the design of the Production Solenoid is changed from bath cooling to conduction cooling.
4) Interfaces with the RFMM need to be better defined.

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.3

Title: MECO Instrumentation

Preparer/Manager: Dave Phillips

Current Cost Est.(FY05 $M) $1.32

Assigned Contingency % 21.6%

Cost Elements (FY05 $M)

Matls	$0.48
Effort	$0.37
Ohd	$0.28
Conting	$0.18
Total	$1.32

WBS Dictionary Definition:
Instrumentation for the delivery of the proton beam from Switchyard to the Production Target and to monitor targeting efficiency. Beamline instrumentation includes EPM's (4), current transformers (2), beam position monitors (4), loss monitors and collimator motion control. Target monitoring devices are pin diodes (10), target flag, target telescope and target temperature monitor.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	30%	Engineered Design	30%
Engineered Conceptual	20%	Scientist Conceptual	15%
Guess	5%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development:
Beamline instrumentation is similar to existing designs.

Issues (funding, collaborator shortage, engineering help, etc.):
1) Target monitoring is a challenge due to the location of the target inside the Production Solenoid.
2) Extinction confirmation using current transformers will need special electronics.
3) MECO instrumentation needs to be scrubbed for both scope and cost.

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.4 **Title:** MECO Security

Preparer/Manager: Dave Phillips **Current Cost Est.(FY05 $M)** $0.44

Assigned Contingency % 20.2%

Cost Elements (FY05 $M)

Matls	$0.07
Effort	$0.21
Ohd	$0.11
Conting	$0.06
Total	$0.44

WBS Dictionary Definition:
Personnel access system to beam and experimental cave. The system is PLC based modeled after the NASA system.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	25%	Engineered Design	30%
Engineered Conceptual	40%	Scientist Conceptual	5%
Guess	0%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development:
Most of the hardware is commercially available. The software has not been developed but will be similar to the NSRL beam line software.

Issues (funding, collaborator shortage, engineering help, etc.): None

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.5 **Title:** MECO Controls

Preparer/Manager: Dave Phillips **Current Cost Est.(FY05 $M)** $0.31

Assigned Contingency % 24.1%

Cost Elements (FY05 $M)

Matls	$0.13
Effort	$0.07
Ohd	$0.06
Conting	$0.05
Total	$0.31

WBS Dictionary Definition:
All controls interface hardware for the MECO beamline magnet power supplies and beam instrumentation will be specified, procured, assembled, installed and tested. Standard software tools and database will be configured, installed and tested.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	X	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	43%	Engineered Design	22%
Engineered Conceptual	33%	Scientist Conceptual	0%
Guess	2%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development:
No hardware development required. Use of standard RHIC controls elements. Software development is limited to configuring and installing standard components and creating database elements for new modules.

Issues (funding, collaborator shortage, engineering help, etc.):
This WBS needs scrubbing.

MECO
RSVP Review Status Sheet

Date: 1/13/05

WBS No. 1.4.4.6 **Title:** MECO Experiment

Preparer/Manager: Dave Phillips **Current Cost Est.(FY05 $M)** $2.08

Assigned Contingency % 30.2%

Cost Elements (FY05 $M)

Matls	$0.70
Effort	$0.58
Ohd	$0.41
Conting	$0.39
Total	$2.08

WBS Dictionary Definition:
MECO Experiment areas which are C-AD responsibility are the Target System, Solenoid Support, and Experimental Infrastructure. The Target System includes verification of the UCI target design, proto type testing & fabrication, storage & handling design, testing & fabrication, and cooling system design & fabrication. Solenoid support includes MDMG Support, facility infrastructure for the installation of the solenoids & cryogenic system, integration of the cryogenic system with C-AD operations, and installation & hook-up of the solenoid power supplies. Experimental Infrastructure includes electric power & tray, an Electronics Hut, a new Counting House, an Experimental Safety System, and a Clean Room.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists		Similar Technology Works	X
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	10%	Engineered Design	20%
Engineered Conceptual	50%	Scientist Conceptual	10%
Guess	10%	Other (specify)	0%
		Total	100%

Status of Hardware/Software Development:
Production Target design at UCI has shown that a water cooled target is feasible.

Issues (funding, collaborator shortage, engineering help, etc.):
1) This plan assumes the Solenoid System is procured turn Key, C-AD's responsibility for the Solenoid System may change depending on final procurement method. The current plan has, for the most part, the minimal amount of work assigned to C-AD.

2) This WBS needs scrubbing.

AGS Project Office
RSVP Review Status Sheet

Date: 14-Jan-05

WBS No. 1.4.5 **Title:** AGS Project Office

Preparer/Manager: P. Pile **Current Cost Est.(FY05 $M)** $2.80

Assigned Contingency % 20%

Cost Elements (FY05 $M) assumes a 5 year construction effort

Effort	$1.57
Matls	$0.11
Ohd	$0.78
Conting	$0.34
Total	$2.80

WBS Dictionary Definition: This WBS contains the effort associated with the project office at BNL for RSVP Booster, AGS, Switchyard, primary beam lines, experimental areas and the K0PI0 neutral beam. The effort includes the project manager and deputy, mechanical and electrical system managers, project controls, installation and conventional facilities coordination, QA and ES&H and financial oversight. This staff responds to all requests from the RSVP Project Office

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	0%	Engineered Design	0%
Engineered Conceptual	0%	Scientist Conceptual	0%
Guess	10%	Known Personnel Costs	90%
		Total	100%

Status of Hardware/Software Development:
Microsoft Excel and Project software in hand, RSVP specific Microsoft Access data base program now available

Issues (funding, collaborator shortage, engineering help, etc.):
- The resource needs for this office must be coordinated with what's available in the RSVP Project Office
- A good direct line of communications with RSVP Project Office exists but there's an abundance of managers above the AGS Project Office, leads to lack of timely guidance
- The RSVP Project Office has yet to provide a PMP or PEP
- Imminent loss of the MECO Project Manager
- Insufficient budget for work to be done this year (plan to use K0PI0 and MECO funds as required once Project Office funds are exhausted to complete base-line work)
- Personnel – balancing RHIC and RSVP needs, March 2005 C-AD RIF, many new hires needed for project start

Beam Development
RSVP Review Status Sheet

Date: 13-Jan-05

WBS No. 1.4.1.6 **Title:** Beam Development

Preparer/Manager: P. Pile/L. Ahrens **Current Cost Est.(FY05 $M)** $14.35

Assigned Contingency % 0%

Cost Elements (FY05 $M) assumes a 5 year construction effort

Effort	$4.78
Matls	$4.17
Ohd	$2.70
Power	$2.69
Conting	$0.00
Total	$14.35

WBS Dictionary Definition: This effort provides resources to develop AGS beams to match experiment requirements. Resources include a 14 FTE supplement to current RHIC operations and support personnel as well as covers incremental costs for power, materials and laboratory distributed technical services. This does not supply sufficient resources for full operation of experiments.

Technical Level of Confidence: (choose one)

Prototype Demonstrated		Elements Built & Tested	
Similar System Exists	x	Similar Technology Works	
Novel System Concept		No Candidate Concept Yet	
Other (Comment)			

Basis of the Cost Estimate: (by percentage of total cost: sum of fractions = 100%)

Commercial Product	0%	Engineered Design	0%
Engineered Conceptual	0%	Past AGS SEB costs	50%
Guess	20%	Known Personnel Costs	30%
		Total	100%

Status of Hardware/Software Development:

(1) AGS/Booster not ready for high intensity operation, component repair/replacement, radiation caps needed - 2-3 years of work

(2) K0PI0 (25 MHZ) and MECO specific modifications to the AGS should be available in third year of RSVP construction (1st year of beam development). K0pi) 100 MHz cavity available later (if needed).

Issues (funding, collaborator shortage, engineering help, etc.):

- Overall plan integrating machine and experiment needs is still being developed - some things will likely not be done during the 3 year development time and will have be done during physics operations period.
- K0PI0 beam intensity/spill is ~40% above previously achieved.
- MECO beam intensity per AGS RF bucket is ~100% above previously achieved levels and protons/second is ~100% above present AGS/Booster ALARA limits (component activation issue).
- Both experiments require special beam bunching with between bunch extinction requirements that may be difficult to achieve, especially with high intensity.